California Department of Pesticide Regulation
Environmental Monitoring Branch
1001 I Street, Sacramento CA 95814-2828
P.O. Box 4015, Sacramento CA 95812-4015

STANDARD OPERATING PROCEDURE

Instructions for sampling benthic macroinvertebrates in wadeable waters using the Modified U.S. EPA EMAP Method.

KEY WORDS

Bioassessment, aquatic insects, benthic macroinvertebrates, substrate

APPROVALS

APPROVED BY: _____ DATE: 1/13/2004
Kean Goh Ph.D.
Environmental Monitoring Branch Management

APPROVED BY: _____ DATE: 11/3/2003
James Harrington
Consulting Senior Scientist, Dept. of Fish and Game

APPROVED BY: _____ DATE: 1/12/04
Carissa Ganapathy
Environmental Monitoring Branch Quality Assurance Officer

PREPARED BY: _____ DATE: 11/5/04
Adriana Moncada
Environmental Monitoring Branch Student Assistant

PREPARED BY: _____ DATE: 11/5/04
Juanita Bacey
Environmental Monitoring Branch Env. Research Scientist

Environmental Monitoring Branch organization and personnel, such as management, senior scientist, quality assurance officer, project leader, etc., are defined and discussed in SOP ADMN002.

STANDARD OPERATING PROCEDURE
Instructions for sampling benthic macroinvertebrates in wadeable waters using the Modified U.S. EPA EMAP Method.

1.0 INTRODUCTION

1.1 Purpose

This Standard Operation Procedure (SOP) discusses the specific method for sampling benthic macroinvertebrates (BMI) in wadeable surface waters of the Central Valley. It also includes procedures for determining the composition and embeddedness of stream substrates.

1.2 Definitions

1.2.1 X-site – Sampling site as predetermined by the project leader per the study protocol.

1.2.2 Reach – Area of the stream to be sampled, equivalent to 40 times the channel width. The length at minimum is 150 m and maximum is 500 m.

1.2.3 Transect – A transverse line perpendicular to the flow of water.

1.2.4 Riffle – Shallow section of a stream or river with rapid current and a surface broken by gravel, cobble or boulders.

1.2.5 Run – Swiftly flowing stream reach with little surface agitation and no major flow obstructions.

1.2.6 Pool – Still water, low velocity, smooth surface, usually deep compared to other parts of the channel.

1.2.7 Glide – Water moving slowly, with a smooth, unbroken surface.

1.2.8 Sweep – To move a net through the water, back and forth.

1.2.9 Kick – A stationary sampling technique accomplished by positioning the net on the substrate and disturbing the substrate in a 1 square foot area (with feet), for approximately 30 seconds, upstream of the net.

1.2.10 Jab –Thrusting the net into the vegetation, holding the net still while rubbing the vegetation (1 ft^2 section), allowing any attached macroinvertebrates to fall into the net. When no flow is present,

sweep the area of the water with the net once the vegetation has been rubbed.

1.2.11 Substrate – The bottom or base layer within the stream (i.e. sand, cobble, mud).

1.2.12 Thalweg – The flow path, along the length of the stream channel, of the deepest water.

2.0 MATERIALS

2.1 100-meter measuring tape

2.2 D-framed kick net (0.5mm mesh)

2.3 1-L plastic containers (labeled with study number, sample number and sample type)

2.4 Plastic white tray (i.e. 9 x 12 inches)

2.5 Sieve – (0.5mm mesh)

2.6 Forceps

2.7 Denatured alcohol

2.8 Gloves with rubber palms

2.9 Water quality field data form

2.10 Physical habitat quality form

2.11 Bleach

2.12 5-gallon bucket

2.13 Small pieces of white paper (approximately 2 X 2 inches) to use as labels

2.14 Wristwatch

2.15 Flags for transect identification

2.16 Meter stick

2.17 Pencils

3.0 PROCEDURES

Instructions included here are modified from the following document: U.S.EPA, 2001, Western Pilot Study Field Operations Manual for Wadeable Streams.

3.1 Determining the Reach and Sampling Point

Each sampling location will consist of a reach of a stream or creek. In general, the reach will be 40 channel widths in length and include 11 cross-sectional transects positioned at equal intervals up and downstream of the x-site. The samples collected at each transect are used to characterize the community and habitat associated with the sampling reach.

3.1.1 To lay out the sampling reach, choose a spot of average width within approximately 5 stream widths upstream and downstream from the x-site.

3.1.2 If the stream width is less than 4 m, use 150 m as a minimum sample reach length.

3.1.3 If the stream width is greater than or equal to 4 m, multiply the average stream width by 40 m to obtain the reach length. Do not exceed a maximum reach length of 500 m.

3.1.4 The reach must be a minimum of 100 feet below or above any bridge or abutment that may influence the flow of the stream. The downstream end of the reach should be flagged as transect “A.”

3.1.5 Proceed upstream from Transect A with the tape measure and flag the positions of 10 additional transects (labeled “B” through “K” as you move upstream) at intervals equal to 1/10 of the reach length. Enter the channel to make measurements only when necessary to avoid disturbing the stream prior to sampling.

3.1.6 Each transect needs to be sampled at one of three points, Left (L), Center (C), or right (R). Use a digital wristwatch and note the last digit on the watch. If the digit is 1 through 3, sample at the left

point, 4 through 6, sample at the center point, and 7 through 9, sample at the right point.

3.1.7 Beginning at transect A, face upstream and locate the sampling point as ¼ (left), ½ (center), or ¾ (right) of the stream width. Continue to the next transect and sample at the next point following the sequence (left, center, right, left, center, right, etc.) For example, if the sampling spot assigned to transect "A" was "Center", transect "B" is assigned "Right", transect "C" is "Left", and transect "D" is "Center", etc.

3.2 Sample Collection

A kicknet sample is to be collected from each of the 11 transects (Transects A-K) at the assigned sampling points (Left, Center, or Right).

3.2.1 At each sampling point, determine the habitat type and sample as described in sections 3.2.4 through 3.2.8.

3.2.2 After sampling at each sampling point pull the net out of the water. Immerse the net in the stream several times to remove fine sediments and to concentrate organisms at the end of the net. Avoid having any water or material enter the mouth of the net during this procedure.

3.2.3 Proceed to upstream transects, collecting a sample at each transect. When net becomes full, empty it as necessary into a plastic sample container.

3.2.4 Riffle/Run: If there is sufficient current in the area at the sampling point to fully extend the net, classify the habitat as "riffle/run."

3.2.4.1 With the net opening facing upstream, position the net securely on the stream bottom to eliminate gaps under the frame.

3.2.4.2 Sample a 1 ft^2 area in front of the net by holding the bottom of the kick-net against the substrate and then dislodge organisms by rubbing the substrates by hand (using rubber-palmed gloves if possible). Avoid larger rocks that prevent the net from sitting properly on the stream bottom.

3.2.4.3 Vigorously kick the remaining finer substrate for approximately 30 seconds

3.2.4.4 If there is too little water to collect the sample with the kick net, randomly pick up 10 rocks from the riffle and wash the organisms into net. The minimum water area required at each site is $1m^2$ and a depth of 10 cm.

3.2.5 Pool/Glide: If there is insufficient current in the area at the sampling point to fully extend the net, classify the habitat as “pool/glide.”

3.2.5.1 With the net opening facing upstream, position the net securely on the stream bottom to eliminate gaps under the frame.

3.2.5.2 Sample a $1ft^2$ area. Pick up any loose rocks or other large substrate particles within the $1ft^2$ area and hold them over of the net. Dislodge organisms by rubbing the substrate by hand (using rubber-palmed gloves if possible) into the net.

3.2.5.3 Vigorously kick the remaining finer substrate while sweeping the net repeatedly through the disturbed area just above the stream bottom. Keep the net moving so that the organisms trapped in the net will not escape. Continue kicking the substrate and moving the net for 30 seconds.

3.2.5.4 If there is too little water to collect the sample with the kick net, stir up the substrate with your gloved hands and use the net to sweep organisms from the water. The minimum water area required at each site is $1m^2$ and a depth of 10 cm.

3.2.6 Snags: A tree or other woody debris that has been submerged for a relatively long period (not recent deadfall).

3.2.6.1 Sample snags by jabbing the net into medium-sized snag material (sticks and branches), or the net may be placed downstream of the snag, then the snag may be rubbed or kicked to help dislodge organisms. Large logs should be avoided because they are generally difficult to sample adequately.

3.2.7 Vegetated banks: Submerged lower banks with roots and emergent plants should be sampled similarly to snags.

3.2.7.1 Sample by jabbing the net into the habitat. The bank habitat may also be kicked to help dislodge organisms, but only after placing the net downstream.

3.2.7.2 When no flow is present, sampling can be done by holding the net still under the vegetated bank then shaking or rubbing the vegetation in the water, allowing any attached macroinvertebrates to fall into the net.

3.2.8 Submerged macrophytes: Aquatic plants that are rooted on the bottom of the stream are seasonal in occurrence and may not be common in high-gradient streams.

3.2.8.1 Sample submerged macrophytes by bumping or jabbing the net along the bottom of the stream in the rooted areas, avoiding sediments where possible.

3.3 All samples:

3.3.1 When BMI sampling is complete, remove as much detritus as possible from the net without losing any organisms.

3.3.2 Empty the contents of the net into the plastic containers. The sample material should not exceed 3/4 of the total container volume to ensure adequate preservation.

3.3.3 Invert the net and inspect the net for any organisms clinging to the mesh and use forceps if necessary to remove the organisms.

3.3.4 Fill the plastic containers no more than 2/3 full with denatured 95% EtOH. Gently agitate the container to ensure thorough mixing of alcohol and sample.

3.3.5 Place a label (written on white paper and in pencil) inside the container with the following information:

- Stream name
- Reach number or location

- Date/time
- Sampler name(s)

3.3.6 Complete a chain of custody (COC) form for each sample according to protocol and SOP ADMN006.00.

3.4 Determining the Substrate Composition

3.4.1 In each of the 11 transects (A-K), at 5 equally spaced points within each transect, visually estimate particle size according to table shown on Substrate worksheet and record (Attachment B).

3.5 Determining the Substrate Embeddedness

3.5.1 In each of the 11 transects (A-K), at 5 equally spaced points within each transect, visually estimate substrate embeddedness according to table shown on Substrate Embeddedness worksheet and record (Attachment B).

3.6 Information to Document for each Reach

3.6.1 Before leaving the stream, document the site description by mapping the sample reach and transect sampling points. The map should include habitat-types (see sections 3.3.4 through 3.3.8) and important structures (plants and attributes of the stream and bank area).

3.6.2 Complete the Physical Characterization, Substrate Composition and Embeddedness, Water Quality Field Data, and Physical Habitat worksheets (Attachments A through D).

4.0 MAINTENANCE OF SAMPLING EQUIPMENT

4.1 Nets and any wading equipment used should be rinsed in a 1% bleach solution after use in each stream to avoid cross contamination of bacteria and invasive macroinvertebrates between streams.

4.2 When sampling is complete, inspect nets for tears or damage and repair as needed.

5.0 SAMPLE STORAGE

5.1 For long-term storage, samples should be regularly checked for alcohol loss and degradation of the sample.

5.1.1 Within one week of sample collection, replace alcohol with new alcohol. A second and final replacement of alcohol should be conducted on the samples three weeks after sample collection. The samples can be stored up to one year in the final replacement alcohol.

5.1.2 Inspect alcohol level in samples every three months and refill as necessary.

5.2 Samples will be stored in a nonflammable cabinet at less than or equal to 25º C, until sample disposal has been approved.

6.0 REFERENCES

Barbour, M.T., J. Gerritsen, B. D. Snyder, and J. B.Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water: Washington D.C.

Harrington, J. and M. Born. 1999. Measuring the Health of California Streams and Rivers. Sustainable Land Stewardship International Institute.

U.S.EPA, 2001. Environmental Monitoring and Assessment Program – Surface Waters: Western Pilot Study Field Operations Manual For Wadeable Streams. Regional Ecology Branch, Western Ecology Div., Natl. Health and Env. Effects Research Lab.

Attachment A

Physical Characterization

(Modified EPA multi-habitat method)

Study #: _____ **Date/Time:**_____
Sampling Crew: _____ **Location:** _____

Weather Conditions: _____

Lat:		Long:				
Elevation:		Physical habitat quality score:				
Gradient:						
		Avg. =				
% canopy cover:						
		Avg. =				
Canopy cover = Take 4 measurements at each transect facing each direction (north, south, east & west) and average. Total reach canopy cover = the average of these 11 numbers.						
Depth:						
		Avg. =				
Depth is measured in thalweg of each transect and averaged						
Comments:						

Watershed features	Description	**Local watershed NPS pollution**	
Forest	_____	No evidence	_____
Field/Pasture	_____	Some potential sources	_____
Agricultural	_____	Obvious sources	_____
Residential	_____	**Local watershed erosion**	
Commercial	_____	None	_____
Industrial	_____	Moderate	_____
Other	_____	Heavy	_____

Physical Characterization
(Modified EPA multi-habitat method)

Instream features

- Stream width is considered to be of "typical" width within approximately 5 stream widths upstream and downstream of the center of the reach.

Reach length (m) _____
Stream width (m) _____
Sampling reach area (m^2) _____ (feet x 0.3048m = meters)
Area in km^2 (m^2x1000) _____ (yards x 0.9144m = meters)

Aquatic vegetation (Indicate the dominant type (%) and record the dominant species present)

Rooted emergent	_____	Free floating	_____
Rooted submergent	_____	Floating algae	_____
Rooted floating	_____	Attached algae	_____
Dominant species present	_____		
Portion of the reach with aquatic vegetation			

Note: All water chemistry measurements, water and sediment samples are to be collected from the bottom of the reach.

Habitat Types (Indicate the % of each habitat type present)		**Organic substrate components** (Does not necessarily add up to 100%)	
Cobble		**Substrate type**	**% Composition in reach**
Gravel		Detritus (Sticks, wood, coarse plant materials (CPOM))	
Mud			
Sand and fine sediment		Muck-mud (Black, very fine organic (FPOM))	
Snags			
Vegetated Banks (undercuts & overhangs)		Marl (Grey, shell fragments)	
Submerged macrophytes			
Other			

Attachment B

SUBSTRATE SIZE

Study #: _____ Date/Time: _____
Sampling Crew: _____ Location: _____

PARTICLE SIZE CLASS (mm)	5 evenly spaced stabs per transect	
	Tallies	**Count**
BEDROCK (SMOOTH) (larger than a car)		
Bedrock (rough) (larger than car)		
Large Boulder 1000-4000mm (meterstick to car)		
Small Boulder 250-1000mm (basketball to meterstick)		
Cobble 64-250mm (tennisball to basketball)		
Coarse Gravel 16-64mm (marble to tennisball)		
Fine Gravel 2-16mm (ladybug to marble)		
Sand 0.06-2mm (gritty-up to ladybug size)		
Fines (silt, clay,muck, not gritty)		
Hardpan (firm, consolidated fine substrate)		
Wood (any size)		
Concrete/Asphalt		
Other		

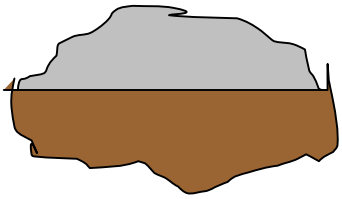
Code	Size Class	Size Range	Description
RS	Bedrock (Smooth)	>4000	Smooth surface rock bigger than a car
RR	Bedrock (Rough)	>4000	Rough surface rock bigger than a car
HP	Hardpan		Firm, consolidated fine substrate
BL	Boulders	>250 to 4000	Basketball to car size
CB	Cobbles	>64 to 250	Tennis ball to basketball size
GC	Gravel (Coarse)	>16 to 250	Marble to tennis ball size
GF	Gravel (Fine)	>2 to 16	Ladybug to marble size
SA	Sand	>0.06 to 2	Smaller than ladybug size, but visible as particles-gritty between fingers
FN	Fines	<0.06	Silt Clay Muck (not gritty between fingers)
WD	Wood	Regardless of Size	Wood & other organic particles
OT	Other	Regardless of Size	Concrete, metal, tires, car bodies etc. (describe in comments)

SUBSTRATE EMBEDDEDNESS

TRANSECT	EMBEDDEDNESS % * (5 evenly spaced stabs per transect)					Average
A						
B						
C						
D						
E						
F						
G						
H						
I						
J						
K						

***** For particles larger than sand, examine the water surface for stains, markings, and algal coatings to estimate the average embeddedness. Embeddedness is the fraction of a particle's surface that is surrounded by sand or finer sediments on the stream bottom. By definition, sand, silt, clay, and mud are embedded 100 percent; bedrock and hardpan are embedded 0 percent.

Example: Fifty percent embedded.



Attachment C

Water Quality Field Data Sheet

(Modified EPA multi-habitat method)

Study #: _____ **Date/Time:**_____

Sampling Crew: _____ **Location:** _____

Weather Conditions: _____

GPS Coordinates			
Avg reach width		Reach Length	

Water Quality		**Samples**	#
Temperature		OP –WAT	
EC		TR – WAT	
DO		PY – WAT	
PH		BU – WAT	
Nitrate		OP -SED	
Phosphate		PY - SED	
Ammonia N		Metals - SED	
Turbidity			
Alkalinity			

Water odors: (i.e. normal, fishy, sewage)	
Water Surface Oils: (i.e. slick, sheen, globs, flecks, none)	
Turbidity: (i.e. clear, slightly turbid, turbid, opaque, stained)	

Diagram of reach

Water Quality Field Data Sheet

(Modified EPA multi-habitat method)

Discharge:

Measured at one channel cross section (representative of the average channel width) within the sampling reach.
Follow procedure as described in SOP FSWA009.00

					VELOCITY					SAMPLING DEPTH(S)					
Dist. From initial point	Width	Depth	.6 or .2/.8	Obser-vation Depth	FPS At Point	V.S. Coef	FPS Mean in Vertical	Area	Dis-charge	WATER DEPTH	0.6	0.2	0.8	Inches to feet	
										0.9	0.5			1	0.08
										1	0.6			2	0.17
										1.1	0.7			3	0.25
										1.2	0.7			4	0.33
										1.3	0.8			5	0.42
										1.4	0.8			6	0.50
										1.5	0.9			7	0.58
										1.6	1.0			8	0.67
										1.7	1.0			9	0.75
										1.8	1.1			10	0.83
										1.9	1.1			11	0.92
										2	1.2			12	1.00
										2.1	1.3				
										2.2	1.3				
										2.3	1.4			Vertical	
										2.4	1.4			Surface	
										2.5	1.5	0.5	2.0	Coef.	
										2.6		0.5	2.1	ratio	
										2.7		0.5	2.2	w/d	Coef
										2.8		0.6	2.2	>1	1.00
										2.9		0.6	2.3	0.50	0.95
										3		0.6	2.4	0.25	0.90
										3.1		0.6	2.5	0.01	0.65
										3.2		0.6	2.6		
										3.3		0.7	2.6		
										3.4		0.7	2.7		
										3.5		0.7	2.8		
										3.6		0.7	2.9		
										3.7		0.7	3.0		
										3.8		0.8	3.0		
										3.9		0.8	3.1		
										4		0.8	3.2		

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____